

REMARKS

By the present amendment, claims 40, 41, 43, 44, and 46 to 49 are pending in the application. Claims 40 and 41 are the independent claims.

§102

Claims 41, 44, 46 and 49 were rejected under 35 U.S.C. §102(b) as being unpatentable over U.S. Patent No. 5,384,335 to Tierney et al.

This rejection is respectfully traversed.

Tierney et al. relates to a process for synthesizing methanol from a synthesis gas comprising H_2 and CO, by use of a mixed catalyst of copper chromite and an alkali or alkaline earth salt. The process is characterized by concurrent synthesis reactions using a mixed catalyst of copper chromite and a basic alkali metal compound, such as an oxide or hydroxide, admixed with a carrier alcohol, in which the alcohol undergoes carbonylation to yield a corresponding alkyl formate. The formate undergoes hydrogenolysis to yield methanol and the carrier alcohol.

Tierney et al. states that even if CO_2 (up to about 6%) and water, blocking the reactions, are present at the start of the reactions, they are decreased to 0.8-1% (CO_2) and 0.3 - 0.5% (H_2O) during the reactions, having no effect on the reaction activities, and the catalyst combination enables the use of a wide range of a H_2/CO ratio.

An object of the present invention is to obtain methanol via methyl formate at a low temperature and a low pressure, without allowing carbon dioxide and water to be activated even if they are present in a raw material. The object itself of the present invention is the same as that of Tierney et al.

According to the present invention, this object is achieved by reacting carbon monoxide and an alcohol in the presence of an alkali metal-type catalyst and/or an alkaline earth metal-type catalyst to form the formate, and during the formation of the formate, making hydrogenolysis catalyst and hydrogen coexist with the foregoing catalyst, to hydrogenolize the formate formed to reduce methanol.

In view of the Examples of Tierney et al., it is highly probable that the reactions in Tierney are different from those in the present invention. In Tierney et al., Examples 1, 2 and 4 show that the alkali metal alkoxide is used without losing its activity. However, it is commonly known that such an alkali metal alkoxide has significant resistance to CO_2 and H_2O involved.

Example 3 of Tierney et al. shows that methoxides, hydroxides, formates, carbonates and bicarbonates all exhibit activity, without providing quantitative experimental results. It is doubtful that catalysts of various anions and cations have the same effect which is far away from the common sense in the art of catalysts. In this Example, it is likely that the alkali metal-type catalysts were not adequately prepared, and were decomposed.

Example 6 of Tierney et al. relates to the resistance of catalysts to CO_2 and H_2O , and indicates that the rate of deactivation is decreased even at a long experimental run. However, this example does not show the amounts of CO_2 and H_2O involved.

As such, in Tierney it is highly probable that the alkali metal-type catalysts have small effects, and a reaction mechanism in which a Cu/Cr catalyst alone forms methanol is dominant.

In addition, the concentration of CO_2 in the raw material gas is 0.1% in all Examples of Tierney et al., which is lower than 4.7% in the present application. In other

words, the poisoned conditions of a catalyst in the present application are more severe than those in Tierney et al.

The process of the present application uses the alkali metal-type catalyst and/or the alkaline earth metal-type catalyst when the reaction at first phase (the formation of a formate from an alcohol and carbon monoxide) and the reaction at second phase (the hydrogenolysis of the formate) are carried out at the same reaction site. The effects of these catalysts used are demonstrated in the Examples in the specification of the present invention. The Examples also demonstrate that the alkali metal-type catalyst and/or the alkaline earth metal-type catalyst function together with a Cu-based catalyst. The specification of the present invention further shows that the formation of methanol proceeds at severe conditions compared with the conditions in Tierney et al.

It is therefore submitted that independent claim 41, and claims 44, 46 and 49 dependent thereon, are patentable over U.S. Patent No. 5,384,335 to Tierney et al.

§103

Claims 40, 42, 43, 45, 47, 48 and 50 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,384,335 to Tierney et al. in view of U.S. Patent No. 4,939,292 to Elliott et al.

Claims 42, 45 and 50 have been canceled by the present amendment. Therefore, the rejection of claims 42, 45 and 50 is now moot.

This rejection, as applied to claims 40, 43, 47 and 48, is respectfully traversed.

The Tierney et al. reference has been previously discussed in detail.

Elliott et al. relates to a process for preparing an ester from an alcohol, the process being characterized by using a novel catalyst. In the process of Elliott, a mixture comprising at least one primary aliphatic alcohol having from 1 to 4 carbon atoms and carbon monoxide come into contact with a catalyst composition consisting of (a) copper or an oxide thereof (b) zinc oxide, (c) at least one metal or compound of a metal selected from cobalt and rhenium, and (d) alumina, under such reaction conditions as to produce a reaction product comprising at least one ester having twice as many carbon atoms per molecule as the primary alcohol, and the at least one ester is separated from the reaction product.

In the process of the present invention, the reaction at the first phase (the formation of a formate from an alcohol and carbon monoxide) and the reaction at the second phase (the hydrogenolysis of the formate) are carried out at the same reaction site, whereas the process of Elliott et al. relates only to the reaction at first phase. Further, the catalyst in Elliott et al. includes Cu and Zn as indispensable components, whereas the catalyst system of the present invention does not include Zn.

Thus, Elliott et al., which is directed to a one-step reaction system, is irrelevant to Tierney et al. as well as the present invention, which are directed to a two-step reaction system. Accordingly, it is not deemed that a person skilled in the art would attempt to combine Tierney et al. with Elliott et al., prior to the filing of the present application. Even if a skilled person did so, it is not deemed that he could readily have conceived of the invention of the present application.

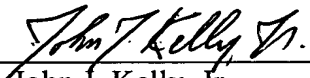
It is therefore submitted that independent claim 40, and claims 43, 47 and 48 dependent thereon, are patentable over U.S. Patent No. 5,384,335 to Tierney et al. in view of U.S. No. 4,939,292 to Elliott et al.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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